

# Chapter 7: Economic Impact Analysis

## INTRODUCTION

The final section 316(b) New Facility Rule applies to a number of industries, but only affects a small number of facilities in each industry. EPA estimates that in total over the next 20 years, the rule will apply to 121 new facilities. EPA conducted an analysis to assess whether it is likely that the final rule will have a significant economic impact on any of the 121 projected new facilities. This chapter presents EPA's analysis of economic impacts for these 121 new facilities. Later chapters consider impacts on small entities (Chapter 8) and on governments, electricity supply, and ratepayers (Chapter 9) as special cases.

The economic impact analysis is conducted at the facility-level. EPA assessed whether the facility-level results indicated the potential for significant impacts or if one firm owned multiple facilities that are affected by the rule. The facility-level analysis showed that nine of the 121 projected new facilities would have annual compliance costs of more than one percent of revenues. Only three of these nine facilities are expected to have a cost-to-revenue ratio of more than three percent. EPA therefore concludes that compliance with this regulation is both economically practicable and achievable at the facility-, firm-, industry and national levels.

The remainder of this chapter is organized as follows:

- ▶ Section 7.1 discusses the methodology used to assess economic impacts for the projected 83 new electric generators, including the approach for estimating the economic characteristics of the regulated facilities, the specific economic impact measures used, and the results of the analysis.
- ▶ Section 7.2 presents the economic impact analysis for the projected 38 new manufacturing facilities. This section discusses the same information as section 7.1 for electric generators.
- ▶ Section 7.3 provides a summary of the economic impact analysis at the facility-level.
- ▶ Section 7.4 discusses the potential for firm- and industry-level impacts as a result of the final section 316(b) New Facility Rule.
- ▶ Section 7.5 presents the impact analysis for the two nuclear case study facilities and four coal facilities for which costs were developed in *Chapter 6: Facility Compliance Costs*.

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## 7.1 NEW STEAM ELECTRIC GENERATORS

EPA projected that 83 new steam electric generators in scope of the final section 316(b) New Facility Rule will begin commercial operation within the next 20 years. The discussion in *Chapter 5: Baseline Projections of New Facilities* explained in detail how EPA developed six model combined-cycle facilities and eight model coal facilities for the costing and economic impact analyses. Each model facility is characterized by its combination of cooling system type (once-through or recirculating system) and source water body (freshwater or marine) as well as its steam electric generating capacity. Within each cooling system/source water body combination, EPA created between one and three model facilities, depending on the number of facilities within that group and the range of their steam electric capacities.

Table 7-1 below presents the 14 model facility types, their cooling system type, the source water body from which they withdraw cooling water, their estimated steam electric capacity, and the number of projected new in-scope facilities that belong to each type.

Table 7-1: Model Facilities for New Electric Generators				
Model Facility Type	Cooling System Type	Source Water Body	Steam Electric Capacity (MW)	Number of Projected New Facilities
CC OT/M-1	Once Through	Marine	1,031	5
CC R/M-1	Recirculating	Marine	489	5
CC R/M-2	Recirculating	Marine	1,030	1
CC R/FW-1	Recirculating	Freshwater	439	18
CC R/FW-2	Recirculating	Freshwater	699	21
CC R/FW-3	Recirculating	Freshwater	1,061	19
Coal OT/FW-1	Once Through	Freshwater	63	1
Coal OT/FW-2	Once Through	Freshwater	515	1
Coal OT/FW-3	Once Through	Freshwater	3,564	1
Coal R/M-1	Recirculating	Marine	812	1
Coal R/FW-1	Recirculating	Freshwater	173	3
Coal R/FW-2	Recirculating	Freshwater	625	3
Coal R/FW-3	Recirculating	Freshwater	1,564	3
Coal RL/FW-1	Recirculating with Lake	Freshwater	660	1

Source: U.S. EPA analysis, 2001.

EPA used two economic impact measures for the 83 new electric generators: (1) the ratio of total annualized compliance costs to estimated revenues (“cost-to-revenue ratio”) and (2) the ratio of initial compliance costs to the construction cost of the plant (“initial cost-to-plant construction cost ratio”).

### 7.1.1 Annualized Compliance Cost to Revenue Measure

Calculating the annualized compliance cost to revenue measure requires the following information for each new in-scope steam electric generator:

- ▶ total annualized compliance costs and
- ▶ estimated annual revenues.

#### a. Annualized compliance costs

Estimating the ratio of annualized compliance cost to estimated revenues (“cost-to-revenue ratio”) required discounting compliance costs that occur in the future and annualizing them over 30 years (the expected useful life of the compliance equipment).<sup>1</sup> *Chapter 6: Facility Compliance Costs* presented EPA’s methodology for estimating model facility costs and annualizing them to determine the national cost of the final section 316(b) New Facility Rule. In contrast to the national cost estimate, which considered all costs incurred during the first 30 years *of the rule* (i.e., 2001 to 2030), the impact analysis presented in this chapter considers compliance costs incurred during the first 30 years *of each facility’s life*.<sup>2</sup>

EPA estimated annualized compliance costs for the impact analysis by first calculating the present value of the stream of costs over the first 30 years of each facility’s life, beginning with the year that the costs are incurred. The present value was determined as of the first year of operation of each facility.<sup>3</sup> This present value was then annualized over 30 years to derive the constant annual value of the stream of future costs. This calculation used a seven percent discount rate (see formulas in *Chapter 6: Facility Compliance Costs*, Section 6.3).

#### b. Estimated annual revenues

EPA estimated expected annual revenues by making assumptions about future electricity sales for each facility. This calculation used the following formula:

$$Rev_x = GenCap_x * ESF * Price$$

where:

$Rev_x$	=	Annual revenues of model facility x
$GenCap_x$	=	Generation capacity of model facility x (in MW)
ESF	=	Projected electricity sales factor (in MWh/MW)
Price	=	Projected electricity price (in \$2000)

Each component of this calculation is further explained below.

#### ❖ Generating capacity

The generating capacities of the model facilities are the average capacities of the actual facilities upon which the model facilities are based (57 NEWGen facilities for the six combined-cycle model facilities; 41 existing section 316(b) Industry Survey facilities for the eight coal model facilities). *Chapter 5: Baseline Projections of New Facilities* and its appendix provide more detail on model facility development, including the generating capacity estimate.

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<sup>1</sup> Annualizing compliance costs over the useful life of the equipment is in accordance with standard Agency practice.

<sup>2</sup> Including 30 years of compliance costs for each facility (beginning when the costs are incurred) is a better indicator of potential facility-level impact than limiting costs to the first 30 years of the rule, which would exclude some out-year costs for facilities constructed later in the 30-year period.

<sup>3</sup> Discounting compliance costs back to the first year of the facility’s operation as opposed to the first year of the rule will increase the facility-level annualized cost for all facilities except those that begin operation in the first year.

### ❖ *Electricity sales factor*

EPA estimated the average amount of electricity sold per MW of generating capacity using forecasts from the Energy Information Administration's (EIA) *Annual Energy Outlook 2001* (U.S. DOE, 2000a). The calculation was made by dividing the total projected annual electricity sales between 2001 and 2010 by the total projected capacity over the same time period, using the following formula:

$$ESF = \frac{\sum_{t=2001}^{2010} \text{Electricity Sold}}{\sum_{t=2001}^{2010} \text{GenCap}}$$

where:

ESF	=	Projected electricity sales factor
Electricity Sold	=	AEO2001 annual electricity sales forecast (in MWh)
GenCap	=	AEO2001 annual generating capacity forecast (in MW)
t	=	Year of forecast (from 2001 to 2010)

EPA developed separate electricity sales factors for new coal facilities and new combined-cycle facilities. For coal facilities, EPA used the national forecast of electricity sales and generating capacity associated with coal energy sources only. However, electricity sales were not available for combined-cycle technologies. Therefore, EPA used the average electricity sales and capacity across all energy sources. EPA believes that this average is a reasonable approximation for combined-cycle facilities, which are primarily designed to supply peak and intermediate capacity but can also be used to meet baseload requirements (U.S. DOE, 2000a, p. 73). They are therefore likely to have dispatch frequencies close to the average for all facilities.<sup>4</sup>

### ❖ *Electricity price*

The final component needed to calculate annual revenues is the price of electricity. EPA used a national price of generation, excluding transmission and distribution charges, forecasted by the U.S. Department of Energy's *Policy Office Electricity Modeling System* (POEMS, U.S. DOE 1999). The generation price reflects the amount of revenue plants are likely to receive in a deregulated electricity market in which transmission and distribution services are separated from the generation function. POEMS forecasts electricity prices for several years into the future under a reference case and a competitive case. For this analysis, EPA took the U.S. average of six forecasted prices: the projections for 2005, 2010 and 2015, each under the reference case and the competitive case (U.S. DOE, 1999).<sup>5</sup>

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<sup>4</sup> The actual amount of electricity that is generated and sold by a facility depends on how often the facility's units are dispatched. Using the calculated factors may therefore over- or underestimate actual facility sales. The factors would *overestimate* electricity sales, and therefore estimated revenues, if the projected new electric generators were dispatched *less* than the average facility; they would *underestimate* sales and revenues if the new facilities were dispatched *more* than the average.

<sup>5</sup> EPA also considered using the EIA's *Annual Energy Outlook 2001* (AEO2001) forecasts, but the available AEO results do not distinguish the price of generation from the distribution and transmission charges.

### c. Results

Table 7-2 presents the results of the annualized compliance cost to revenue analysis for the 83 new electric generators. Projected annual facility revenues range from approximately \$14 million to \$791 million and annualized compliance costs range from approximately \$0.17 million to \$19.1 million. The table shows that the cost-to-revenue ratio for the new electric generators ranges between 0.07 and 5.24 percent. Five of the model facility types which represent nine projected new facilities have an impact of greater than one percent. Of these nine facilities, three facilities (represented by three model facility types) have an impact of greater than three percent.

<b>Model Facility Type</b>	<b>Steam Electric Capacity (MW)</b>	<b>Electricity Sales Factor</b>	<b>Annual Electricity Sales (MWh)</b>	<b>Price (\$/MWh)</b>	<b>Estimated Annual Revenues</b>	<b>Annualized Compl. Cost</b>	<b>Annualized Compl. Cost/ Annual Revenues</b>	<b>No. of New In-Scope Facilities</b>
CC OT/M-1	1,031	4,566	4,709,114	\$32.62	\$154	\$3.2	<b>2.07%</b>	<b>5</b>
CC R/M-1	489	4,566	2,234,118	\$32.62	\$73	\$0.20	<b>0.27%</b>	<b>5</b>
CC R/M-2	1,030	4,566	4,703,406	\$32.62	\$153	\$0.20	<b>0.13%</b>	<b>1</b>
CC R/FW-1	439	4,566	2,002,373	\$32.62	\$65	\$0.17	<b>0.26%</b>	<b>18</b>
CC R/FW-2	699	4,566	3,193,938	\$32.62	\$104	\$0.18	<b>0.17%</b>	<b>21</b>
CC R/FW-3	1,061	4,566	4,846,963	\$32.62	\$158	\$0.18	<b>0.11%</b>	<b>19</b>
Coal OT/FW-1	63	6,803	428,284	\$32.62	\$14	\$0.73	<b>5.25%</b>	<b>1</b>
Coal OT/FW-2	515	6,803	3,503,722	\$32.62	\$114	\$3.8	<b>3.33%</b>	<b>1</b>
Coal OT/FW-3	3,564	6,803	24,246,596	\$32.62	\$791	\$19.1	<b>2.41%</b>	<b>1</b>
Coal R/M-1	812	6,803	5,524,323	\$32.62	\$180	\$0.23	<b>0.13%</b>	<b>1</b>
Coal R/FW-1	173	6,803	1,177,021	\$32.62	\$38	\$0.17	<b>0.44%</b>	<b>3</b>
Coal R/FW-2	625	6,803	4,249,202	\$32.62	\$139	\$0.18	<b>0.13%</b>	<b>3</b>
Coal R/FW-3	1,564	6,803	10,641,153	\$32.62	\$347	\$0.24	<b>0.07%</b>	<b>3</b>
Coal RL/FW-1	660	6,803	4,490,156	\$32.62	\$146	\$4.8	<b>3.27%</b>	<b>1</b>

Source: U.S. DOE 1999; U.S. DOE, 2000a; U.S. EPA analysis, 2001.

To test the sensitivity of these result to changes in the price of electricity, EPA re-calculated these impacts using the lowest electricity price of any NERC region projected by POEMS.<sup>6</sup> This price was \$25.38. A lower price reduces the annualized cost because it decreases the value of the energy penalty. However, it also reduces facility revenues. The overall effect is an increase in the cost-to-revenue ratio. Using this lower price would result in only slight increases in the cost-to-revenue ratios for the 83 projected new electric generators: the ratio would range between 0.09 percent and 6.27 percent, compared to 0.07 percent to 5.26 percent using the U.S. average. The number of facilities with impacts of greater than one percent and greater than three percent would remain the same. Based on this analysis, EPA concludes that the impact results are not very sensitive to changes in electricity prices and that even if these changes to the price of electricity occurred, compliance with this regulation is both economically practicable and achievable at the facility-, firm-, industry, and national levels.

<sup>6</sup> Similar to the main analysis, the price used in this sensitivity analysis is the average of the baseline and competitive cases for 2005, 2010, and 2015.

## 7.1.2 Initial Compliance Cost to Plant Construction Cost Measure

Calculating the initial cost-to-plant construction cost ratio requires the following information for each new in-scope steam electric generator:

- ▶ initial compliance costs, and
- ▶ plant construction costs.

### a. Initial compliance cost

Initial compliance costs include the compliance costs of the final section 316(b) New Facility Rule that will be incurred before a new facility can begin operation. These are capital technology costs and initial permit application costs. EPA assumed that facilities would incur capital costs one year before operation begins. Facilities that choose Track II would begin incurring initial permit application costs three years before the start of operations, and Track I facilities one year before the start of operations. Since initial compliance costs are incurred at the same time as the plant construction costs, with which they are compared, it was not necessary to discount these costs or make any other adjustments to them.

### b. Plant construction costs

EPA used the *Assumptions to the Annual Energy Outlook 2001* (U.S. DOE, 2000b) to estimate the total construction cost of the new electric generating facilities. Table 43 of the *Assumptions* presents the cost and performance characteristics of new generating technologies assumed in EIA's electricity forecasts. Technology-specific overnight capital costs were used in the analysis.<sup>7</sup> Overnight capital costs are the base costs estimated to build a plant in a hypothetical *Middletown, USA*. EPA calculated an average value for the projected new combined-cycle facilities, using the cost per kilowatt for three technologies: Advanced Gas/Oil Combined-Cycle, Integrated Coal-Gasification Combined-Cycle, and Conventional Gas/Oil Combined-Cycle. Table 43 presents only one value for coal facilities. The following overnight capital costs were used in the analysis:

- |                                |            |
|--------------------------------|------------|
| ▶ Average Combined Cycle       | \$796/kW   |
| ▶ Conventional Pulverized Coal | \$1,121/kW |

EPA adjusted the overnight capital costs to recognize that learning effects may reduce costs over time. Learning parameters are published in Table 45 of the *Assumptions*. As with the overnight capital costs, EPA calculated an average value for the projected new combined-cycle facilities, using the parameters for the three combined-cycle technologies (Advanced Gas/Oil Combined-Cycle, Integrated Coal-Gasification Combined-Cycle, and Conventional Gas/Oil Combined-Cycle). Table 45 presents only one value for coal facilities. The following parameters were used in the analysis:

- |                                |             |
|--------------------------------|-------------|
| ▶ Average Combined Cycle       | 8.3 percent |
| ▶ Conventional Pulverized Coal | 5.0 percent |

These parameters are the minimum total learning by 2020 and may overstate cost reductions for facilities constructed in the early years of the rule.

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<sup>7</sup> EIA's overnight capital cost include contingency factors, but exclude regional multipliers and learning effects. Interest charges are also excluded. These represent costs of new projects initiated in 2000. EPA adjusted the overnight capital costs from 1999 to 2000 dollars using the Engineering News-Record Construction Cost Index. EPA did not make an adjustment for regional multipliers this analysis uses the U.S. average. No adjustment for interest charges was necessary because the compliance costs, to which the overnight capital costs are compared, also do not include interest charges. Adjustments for learning effects are discussed below.

### c. Results

Table 7-3 presents the results of the economic impact analysis for the 83 new electric generators. The table shows that the initial cost-to-plant construction cost ratio for the new electric generators ranges between 0.03 and 3.45 percent. Four of the model facility types which represent eight projected new facilities have an impact of greater than one percent. Only one model facility type, which represents one projected new facility, has an impact of greater than three percent.

<b>Model Facility Type</b>	<b>Steam Electric Capacity (MW)</b>	<b>Plant Construction Cost (\$/kW)<sup>a</sup></b>	<b>Total Plant Construction Cost (mill.)</b>	<b>Initial Compl. Cost (mill.)</b>	<b>Compl. Cost/Construction Cost</b>	<b>No. of New In-Scope Facilities</b>
CC OT/M-1	1,031	\$730	\$753	\$13.6	<b>1.81%</b>	<b>5</b>
CC R/M-1	489	\$730	\$357	\$0.20	<b>0.06%</b>	<b>5</b>
CC R/M-2	1,030	\$730	\$752	\$0.28	<b>0.04%</b>	<b>1</b>
CC R/FW-1	439	\$730	\$320	\$0.21	<b>0.07%</b>	<b>18</b>
CC R/FW-2	699	\$730	\$511	\$0.22	<b>0.04%</b>	<b>21</b>
CC R/FW-3	1,061	\$730	\$775	\$0.24	<b>0.03%</b>	<b>19</b>
Coal OT/FW-1	63	\$1,065	\$67	\$2.3	<b>3.45%</b>	<b>1</b>
Coal OT/FW-2	515	\$1,065	\$549	\$11.1	<b>2.02%</b>	<b>1</b>
Coal OT/FW-3	3,564	\$1,065	\$3,796	\$36.5	<b>0.96%</b>	<b>1</b>
Coal R/M-1	812	\$1,065	\$865	\$0.57	<b>0.07%</b>	<b>1</b>
Coal R/FW-1	173	\$1,065	\$184	\$0.18	<b>0.10%</b>	<b>3</b>
Coal R/FW-2	625	\$1,065	\$665	\$0.31	<b>0.05%</b>	<b>3</b>
Coal R/FW-3	1,564	\$1,065	\$1,666	\$0.87	<b>0.05%</b>	<b>3</b>
Coal RL/FW-1	660	\$1,065	\$703	\$14.4	<b>2.05%</b>	<b>1</b>

<sup>a</sup> Plant Construction Cost = Overnight Capital Cost \* (1 - Learning Parameter).

Source: U.S. DOE, 2000b; U.S. EPA analysis, 2001.

## 7.2 NEW MANUFACTURING FACILITIES

EPA projected that 38 new manufacturing facilities in scope of the section 316(b) New Facility Rule will begin commercial operation within the next 20 years (see *Chapter 5: Baseline Projections of New Facilities*). The 38 new manufacturing facilities include 22 chemical facilities, 10 steel facilities, two aluminum facilities, two paper mills, and two petroleum refineries.

The discussion in *Chapter 5: Baseline Projections of New Facilities* explained in detail how EPA developed model manufacturing facilities for the costing and economic impact analyses. Within each 4-digit SIC code, EPA developed one model facility for each cooling system type/source water body combination with at least one projected new in-scope facility.<sup>8</sup>

<sup>8</sup> The four potential cooling system type/source water body combinations are (1) once-through/freshwater, (2) once-through/marine, (3) recirculating/freshwater, and (4) recirculating/marine.



EPA analyzed economic impacts for each of those model facilities.

EPA used annualized compliance costs as a percent of average annual revenues (“cost-to-revenue ratio”) as a measure of economic impacts for manufacturing facilities. The comparison of initial compliance costs to plant construction costs used for electric generators could not be estimated for manufacturing facilities because information on facility construction cost is not readily available.

### 7.2.1 Annualized Compliance Cost to Revenue Measure

Estimation of the cost-to-revenue ratio requires the following information for each new in-scope manufacturing facility:

- ▶ total annualized compliance cost, and
- ▶ estimated annual revenues.

#### a. Annualized compliance cost

EPA used the same methodology to estimate annualized compliance costs for the projected new manufacturing facilities as was used for the new electric generators described above: EPA discounted compliance costs that occur in the future and annualizing them over 30 years (the expected useful life of the compliance equipment). *Chapter 6: Facility Compliance Costs* presented EPA’s methodology for estimating model facility costs and annualizing them to determine the national cost of the final section 316(b) New Facility Rule. In contrast to the national cost estimate, which considered all costs incurred during the first 30 years *of the rule* (i.e., 2001 to 2030), the impact analysis presented in this chapter considers compliance costs incurred during the first 30 years *of each facility’s life*.<sup>9</sup>

EPA estimated annualized compliance costs for the impact analysis by first calculating the present value of the stream of costs over the first 30 years of each facility’s life. The present value was determined as of the first year of operation of each facility.<sup>10</sup> This present value was then annualized over 30 years to derive the constant equivalent annual value of the stream of future costs. This calculation used a seven percent discount rate (see formulas in *Chapter 6: Facility Compliance Costs*, Section 6.3).

#### ❖ Estimated annual revenues

EPA estimated facility-level revenues for the 38 projected new facilities using information for existing facilities in the relevant industries. The Agency used results from the section 316(b) *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures* to project revenues, using the following methodology:

- ▶ **Calculating average revenues:** EPA assumed that the financial characteristics of the existing in-scope facilities would be similar to the projected new facilities. To develop revenues for the model facilities, EPA calculated an average revenue for all of the existing facilities with the same characteristics as that model facility.<sup>11</sup>
- ▶ **Supplement missing data, where necessary:** Some of the existing in-scope facilities upon which the model facilities are based did not report revenues in the detailed industry questionnaire. For these facilities, EPA estimated facility revenues using firm-level revenues.<sup>12</sup> EPA multiplied firm revenues by the ratio of facility employment to firm employment, making the assumption that revenues per employee would be the same on the facility level as on the firm level.

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<sup>9</sup> Including 30 years of compliance costs for each facility is a better indicator of potential facility-level impact than limiting costs to the first 30 years of the rule.

<sup>10</sup> Discounting compliance costs back to the first year of the facility’s operation as opposed to the first year of the rule will increase the facility-level annualized cost for all facilities except those that begin operation in the first year.

<sup>11</sup> The same facilities were used to calculate the average flows of that model facility.

<sup>12</sup> EPA used firm-level revenues from the section 316(b) Industry Survey. For one facility, EPA used Dun and Bradstreet data because neither facility nor firm revenues were available from the survey (D&B, 2001).



Table 7-4 presents the results of the economic impact analysis for the 38 projected new manufacturing facilities. The table shows that the cost-to-revenue ratio for the 38 facilities ranges between 0.01 percent and 0.50 percent. No facilities are expected to have a cost-to-revenue ratio of greater than one percent. Based on the low values of this impact measure, EPA believes that the economic impacts of the final section 316(b) New Facility Rule on new manufacturing facilities will be minimal.

<b>Table 7-4: Annualized Compliance Cost to Revenue Measure for New In-Scope Manufacturers (\$2000 mill.)</b>							
<b>Model Facility Type</b>	<b>SIC Code</b>	<b>Cooling System Type</b>	<b>Source Water Body</b>	<b>Total Annualized Compl. Cost<sup>a</sup></b>	<b>Estimated Annual Revenues</b>	<b>Annualized Compl. Cost/ Revenues</b>	<b>No. of New In-Scope Facilities</b>
MAN OT/F-2621	2621	Once-Through	Freshwater	\$0.38	\$234	<b>0.16%</b>	2
MAN OT/M-2812	2812	Once-Through	Marine	\$1.6	\$517	<b>0.30%</b>	1
MAN OT/F-2812	2812	Once-Through	Freshwater	\$0.67	\$943	<b>0.07%</b>	1
MAN OT/M-2819	2819	Once-Through	Marine	\$0.45	\$226	<b>0.20%</b>	2
MAN OT/F-2819	2819	Once-Through	Freshwater	\$0.35	\$104	<b>0.34%</b>	2
MAN OT/F-2821	2821	Once-Through	Freshwater	\$0.64	\$483	<b>0.13%</b>	4
MAN OT/F-2834	2834	Once-Through	Freshwater	\$0.35	\$70	<b>0.50%</b>	2
MAN OT/F-2869	2869	Once-Through	Freshwater	\$0.46	\$1,045	<b>0.04%</b>	7
MAN RE/F-2869	2869	Recirculating	Freshwater	\$0.18	\$956	<b>0.02%</b>	1
MAN OT/F-2873	2873	Once-Through	Freshwater	\$0.42	\$111	<b>0.38%</b>	1
MAN RE/F-2873	2873	Recirculating	Freshwater	\$0.21	\$415	<b>0.05%</b>	1
MAN OT/F-2911	2911	Once Through	Freshwater	\$0.73	\$1,562	<b>0.05%</b>	1
MAN RE/F-2911	2911	Recirculating	Freshwater	\$0.18	\$2,246	<b>0.01%</b>	1
MAN OT/F-3312	3312	Once-Through	Freshwater	\$0.85	\$1,076	<b>0.08%</b>	5
MAN RE/F-3312	3312	Recirculating	Freshwater	\$0.77	\$595	<b>0.13%</b>	1
MAN OT/F-3316	3316	Once-Through	Freshwater	\$0.37	\$118	<b>0.32%</b>	1
MAN RE/F-3316	3316	Recirculating	Freshwater	\$0.20	\$362	<b>0.05%</b>	1
MAN OT/F-3317	3317	Once-Through	Freshwater	\$0.45	\$222	<b>0.20%</b>	1
MAN RE/F-3317	3317	Recirculating	Freshwater	\$0.18	\$217	<b>0.08%</b>	1
MAN OT/F-3353	3353	Once-Through	Freshwater	\$0.43	\$444	<b>0.10%</b>	1
MAN RE/F-3353	3353	Recirculating	Freshwater	\$0.18	\$939	<b>0.02%</b>	1

<sup>a</sup> The total annualized compliance costs of all facilities, except the two facilities in SIC code 2812, are based on the assumption that initial permit costs and capital costs are incurred prior to the facility's operation. The two facilities in SIC code 2812, and other manufacturing facilities projected to begin operation during 2001, 2002, or 2003 would incur part of these costs concurrent with the first three years of operation.

Source: U.S. EPA analysis, 2001.

### 7.3 SUMMARY OF FACILITY-LEVEL IMPACTS

The economic impact analysis for the final section 316(b) New Facility Rule shows that the requirements of this regulation would have minimal impacts on projected new electric generators and manufacturing facilities. Of the 121 projected facilities, only nine facilities are expected to incur annualized costs greater than one percent of revenues. Initial compliance costs compared to the plant construction costs are also expected to be small for electric generators. Table 7-5 summarizes the results of the impact analysis by industry sector.

Table 7-5: Compliance Costs and Economic Impacts by Sector					
Sector	Number of Projected New In Scope Facilities	Total Annualized Compl. Cost/ Annual Revenues		Initial Compl. Cost/ Plant Construction Cost	
		Lowest	Highest	Lowest	Highest
SIC 49 Steam Electric Generating	83	0.07%	5.24%	0.03%	3.45%
SIC 26 Pulp & Paper	2	0.16%	0.16%		
SIC 28 Chemicals	22	0.02%	0.50%		
SIC 29 Petroleum	2	0.01%	0.05%		
SIC 331 Steel	10	0.05%	0.32%		
SIC 333/335 Aluminum	2	0.02%	0.10%		
Total	121	0.01%	5.24%		

Source: U.S. EPA analysis, 2001.

To test the sensitivity of these result to the length of the amortization period, EPA re-calculated the impact ratios using a 15-year amortization period. This 15-year period may more closely reflect the financing terms for some of the new in-scope facilities in the current market, especially for generators operating in deregulated electricity markets. The shorter amortization period only affects initial compliance costs, including capital costs and initial permitting costs. All other compliance costs are annual costs and are not affected by the amortization period.<sup>13</sup> Using a 15-year amortization period would result in two different impact ratio values for each facility during the 30-year analysis period: (1) a higher ratio for the first 15 years, which reflects full amortization of the capital costs and the initial permitting costs associated with the rule; and (2) a lower ratio which reflects the on-going costs over the second 15 years but does not include any charges for capital costs and initial permitting. EPA only calculated the first, higher, impact ratio in this sensitivity analysis.

For electric generators, reducing the amortization period to 15 years would result in only slight increases in the cost-to-revenue ratios. The ratio would range between 0.08 percent and 5.73 percent (compared to 0.07 percent to 5.24 percent using a 30-year amortization period). The number of facilities with impacts of greater than one percent and greater than three percent would remain the same.<sup>14</sup> For manufacturing facilities, the change in impacts from reducing the amortization period to 15 years would be equally small. The ratio would range between 0.01 percent and 0.57 percent (compared to 0.01 percent to 0.50 percent using the 30-year amortization period). No manufacturing facilities are expected to have a cost-to-revenue ratio of greater than one percent.

<sup>13</sup> The only other compliance cost that is not an annual cost is the cost of repermitting. However, this cost is very minor and will not be incurred until five years after the facility begins operation. EPA does not expect this cost to be included in the initial 15-year loan arrangement and therefore annualized it over 30 years.

<sup>14</sup> The change in amortization period does not affect the initial cost-to-plant construction cost ratio because for this measure, compliance costs are not discounted and annualized.

Based on this analysis, EPA concludes that even if some facilities have to finance their debt over a shorter period of time, compliance with this regulation is both economically practicable and achievable at the facility-, firm-, industry-, and national levels.

## 7.4 POTENTIAL FOR FIRM- AND INDUSTRY-LEVEL IMPACTS

The previous section presented EPA's estimate of facility-level impacts as a result of the final section 316(b) New Facility Rule. Given the low impacts on the facility-level, EPA did not conduct a formal impact analysis at the firm- or industry-levels. Based on the analysis presented in this chapter, EPA concludes that the final section 316(b) New Facility Rule will not cause impacts on the firms owning the projected new in-scope facilities or on their industries, for reasons discussed in this section.

The final rule is expected to increase the cost of the projected new in-scope facilities relative to other new facilities and to existing facilities. Annualized compliance costs as a percentage of revenues at the facility-level ranged from 0.07 to 5.24 percent for new electric generators and from 0.01 to 0.50 percent for new manufacturing facilities. Since firm revenues are always equal to or greater than facility-level revenues, the cost-to-revenue ratio at the firm-level cannot be higher than at the facility-level. In most cases, this ratio would be lower. EPA therefore concluded that significant firm-level impacts as a result of the final section 316(b) New Facility Rule are unlikely.

A rule that substantially increases the cost of new facilities could present a barrier to new entry, and constrain capacity growth in the affected industries. Barriers to new entry result in higher product prices in the long run and can retard valuable technological innovation. EPA concluded that the final rule is unlikely to discourage new entry, because the compliance costs associated with the final rule are small compared with the expected revenues of the projected facilities. Also, EPA expects that facilities will be able to secure financing for the capital costs associated with the rule because these costs represent such a small percentage of the overall plant construction costs. However, the rule may influence the design of cooling systems and choice of water sources of new facilities planning to use cooling water.

Given the small number of affected in-scope facilities relative to the size of the affected industries, EPA also concluded that impacts at the industry-level are very unlikely. The maximum costs incurred in any one year represent a very small percentage of total industry revenues at the 4-digit SIC level. The rule affects too small a portion of any industry to have observable impacts at the industry level. EPA therefore does not expect any impacts on industry productivity, competition, prices, output, foreign trade, or employment. EPA concluded that a detailed market analysis is not required for any of the affected industries, given the screening analysis results.

## 7.5 ADDITIONAL FACILITY ANALYSES

EPA also estimated economic impacts for the six additional facilities costed in Section 6.4 of *Chapter 6: Facility Compliance Costs*. These six facilities include two large nuclear facilities (one with a once-through system and one a recirculating system in the baseline) and four coal facilities installing concrete cooling towers instead of redwood.

Table 7-6 presents the six facilities, for which EPA conducted additional facility analyses, their cooling system type, the type of water body from which they withdraw cooling water, and their estimated capacity.

<b>Table 7-6: Characteristics of Six Additional Facilities</b>			
<b>Model Facility Type</b>	<b>Cooling System Type</b>	<b>Source Water Body</b>	<b>Capacity (MW)</b>
Nuclear-1	Recirculating	Marine	2,708
Nuclear-2	Once-Through	Marine	2,666
Coal OT/FW-1	Once-Through	Freshwater	63
Coal OT/FW-2	Once-Through	Freshwater	515
Coal OT/FW-3	Once-Through	Freshwater	3,564
Coal RL/FW-1	Recirculating with Lake	Freshwater	660

Source: U.S. EPA analysis, 2001.

EPA used the same two economic impact measures for the six additional facility analyses as were used for the 83 projected new electric generators discussed in Section 7.1 above: (1) the ratio of total annualized compliance costs to estimated revenues (“cost-to-revenue ratio”) and (2) the ratio of initial compliance costs to the construction cost of the plant (“initial cost-to-plant construction cost ratio”).

### 7.5.1 Annualized Compliance Cost to Revenue Measure

Calculating the cost-to-revenue ratio requires total annualized compliance costs and estimated annual revenues for each of the six additional facilities. The same methodology described in Section 7.1.1 above was used to calculate annualized compliance costs and annual revenues for these six facilities.

*Chapter 6: Facility Compliance Costs* (Section 6.4) presents facility unit costs for each of the six facilities. EPA estimated annualized compliance costs for the impact analysis by first calculating the present value of the stream of costs over the first 30 years of each facility’s life. The present value was determined as of the first year of operation of each facility. This present value was then annualized over 30 years to derive the constant equivalent annual value of the stream of future costs. This calculation used a seven percent discount rate (see formulas in *Chapter 6: Facility Compliance Costs*, Section 6.3).

EPA estimated expected annual revenues by making assumptions about future electricity sales for each facility. Expected annual revenues are calculated by multiplying generation capacity by an electricity sales factor and the electricity price. EPA estimated the average amount of electricity sold per MW of generating capacity using forecasts from EIA’s *Annual Energy Outlook 2001* (U.S. DOE, 2000a). EPA used the national forecast of electricity sales and generating capacity associated with advanced nuclear facilities to estimate an electricity sales factor for the two nuclear facilities. For the coal facilities, EPA used the same estimates as were used for the model new coal facilities presented in section 7.1.1. EPA also used the same price forecasts presented in section 7.1.1.

Table 7-7 presents the results of the annualized compliance cost to revenue analysis for the six facilities. The table shows that the cost-to-revenue ratios for the recirculating and once-through nuclear facilities are 0.1 percent and 4.3 percent, respectively. The cost-to-revenue ratios are almost identical whether the coal facilities install concrete or redwood cooling towers, with impacts ranging from 2.4 percent to 5.3 percent for concrete towers and 2.4 to 5.2 percent for redwood towers.

<b>Table 7-7: Annualized Compliance Cost to Revenue Measure for Six Additional Facilities (\$2000 millions)</b>							
<b>Model Facility Type</b>	<b>Steam Electric Capacity (MW)</b>	<b>Electricity Sales Factor</b>	<b>Annual Electricity Sales (MWh)</b>	<b>Price (\$/MWh)</b>	<b>Estimated Annual Revenues</b>	<b>Annualized Compl. Cost</b>	<b>Annualized Compl. Cost/ Annual Revenues</b>
Nuclear-1	2,708	7,616	20,624,616	\$32.62	\$673	\$0.4	<b>0.1%</b>
Nuclear-2	2,666	7,616	20,304,736	\$32.62	\$662	\$28.2	<b>4.3%</b>
Coal OT/FW-1	63	6,803	428,284	\$32.62	\$14	\$0.7	<b>5.3%</b>
Coal OT/FW-2	515	6,803	3,503,722	\$32.62	\$114	\$3.8	<b>3.4%</b>
Coal OT/FW-3	3,564	6,803	24,246,596	\$32.62	\$791	\$19.2	<b>2.4%</b>
Coal RL/FW-1	660	6,803	4,490,156	\$32.62	\$146	\$4.8	<b>3.3%</b>

Source: U.S. DOE 1999; U.S. DOE, 2000a; U.S. EPA analysis, 2001.

## 7.5.2 Initial Compliance Cost to Plant Construction Cost Measure

Calculating the initial cost-to-plant construction cost ratio requires initial compliance costs and plant construction costs for each of the six facilities. The same methodology and data sources as described in section 7.1.2 above were used to calculate initial compliance costs and plant construction costs for the two nuclear facilities. The four coal facilities have the same characteristics as the coal model new facilities described in section 7.1.2.

The overnight cost and the learning parameter for associated with advanced nuclear facilities are:

- ▶ Overnight cost                      \$2,246/kW
- ▶ Learning parameter              10.0 percent

Table 7-8 presents the results of the economic impact analysis for the six facilities. The table shows that the initial cost-to-plant construction cost ratio for the recirculating and once-through nuclear facilities are 0.04 percent and 3.8 percent, respectively. The initial cost-to-plant construction cost ratio are slightly higher for the coal facilities installing concrete cooling towers with impacts ranging from 1.4 percent to 4.6 percent compared to impacts ranging from 0.96 percent to 3.5 percent when installing redwood cooling towers.

<b>Table 7-8: Initial Compliance Cost to Construction Cost Measure for Six Additional Facilities (\$2000)</b>					
<b>Model Facility Type</b>	<b>Steam Electric Capacity (MW)</b>	<b>Plant Construction Cost (\$/kW)<sup>a</sup></b>	<b>Total Plant Construction Cost (mill.)</b>	<b>Initial Compl. Cost (mill.)</b>	<b>Compl. Cost/ Construction Cost</b>
Nuclear-1	2,708	\$2,021	\$5,474	\$2.4	<b>0.04%</b>
Nuclear-2	2,666	\$2,021	\$5,390	\$204.1	<b>3.79%</b>
Coal OT/FW-1	63	\$1,065	\$67	\$3.1	<b>4.62%</b>
Coal OT/FW-2	515	\$1,065	\$549	\$15.9	<b>2.90%</b>
Coal OT/FW-3	3,564	\$1,065	\$3,796	\$53.5	<b>1.41%</b>
Coal RL/FW-1	660	\$1,065	\$703	\$20.4	<b>2.90%</b>

<sup>a</sup> Plant Construction Cost = Overnight Capital Cost \* (1 - Learning Parameter).

Source: U.S. DOE, 2000b; U.S. EPA analysis, 2001.

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